

We claim:

1. A carbonation system comprising:
  - a vessel for carbonating a liquid, the longitudinal axis of said vessel being in the horizontal plane;
  - a CO<sub>2</sub> supply connected to said vessel so as to create a CO<sub>2</sub> atmosphere in said vessel;
  - an inlet diffuser through which the liquid enters said vessel, said inlet diffuser comprising a plurality of openings arranged on a vertical face, wherein the plurality of openings are oriented such that when the liquid exits said inlet diffuser through the plurality of openings, the liquid is substantially atomized and the atomized liquid is ejected in a direction that is substantially in the horizontal plane; and
  - an outlet pipe through which the carbonated liquid exits said vessel.
2. A carbonation system according to claim 1, wherein the plurality of openings are holes.
3. A carbonation system according to claim 2, wherein the diameters of the holes are approximately 0.016-0.036 inches.
4. A carbonation system according to claim 1, wherein the plurality of openings are slots.
- 25 5. A carbonation system according to claim 1, wherein the plurality of openings are a combination of holes and slots.
6. A carbonation system according to claim 1, wherein the inlet liquid pressure is approximately 100 to 140 psi.

7. A carbonation system according to claim 1, wherein said inlet diffuser is positioned in the approximate longitudinal center of said vessel.

5 8. A carbonation system according to claim 1, where in said vessel is cylindrical in shape.

9. A carbonation system according to claim 1, wherein the plurality of openings are arranged in a plurality of horizontal rows.

10 10. A carbonation system according to claim 1, wherein the plurality of openings are oriented to eject the atomized liquid substantially along the longitudinal axis of said vessel.

15 11. A carbonation system according to claim 1, wherein said vessel comprises end walls at either longitudinal end and the plurality of openings are oriented to eject the atomized liquid toward the end walls of said vessel.

20 12. A carbonation system according to claim 1, wherein said vessel comprises side walls and end walls at either longitudinal end of said side walls, and the plurality of openings are oriented such that the atomized liquid is not ejected toward the side walls of said vessel.

25 13. A carbonation system according to claim 1, wherein said vessel comprises side walls and end walls at either longitudinal end of said side walls, and the plurality of openings are oriented such that the atomized liquid is not ejected toward a central region of the side walls of said vessel.

30 14. A carbonation system comprising:  
a vessel for carbonating a liquid;  
a CO<sub>2</sub> supply connected to said vessel so as to create a CO<sub>2</sub> atmosphere in  
said vessel;

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an inlet diffuser through which the liquid enters said vessel, said inlet diffuser comprising a plurality of openings arranged on a vertical face, wherein the plurality of openings are oriented such that when the liquid exits said inlet diffuser through the plurality of openings, the liquid is substantially atomized and wherein the plurality of openings are arranged in horizontal rows such that openings in adjacent rows of the plurality of openings are not in vertical alignment with each other; and

an outlet pipe through which the carbonated liquid exits said vessel.

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15. A carbonation system according to claim 14, wherein adjacent rows of the plurality of openings have a different number of openings per row.

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16. A carbonation system according to claim 14, where in the inlet liquid pressure is approximately 100 to 140 psi.

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17. A carbonation system according to claim 14, wherein the plurality of openings are holes.

18. A carbonation system according to claim 17, wherein the diameters of the holes are approximately 0.020-0.036 inches.

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19. A carbonation system according to claim 14, wherein the plurality of openings are slots.

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20. A carbonation system according to claim 14, wherein the plurality of openings are a combination of holes and slots.

21. A carbonation system according to claim 14, wherein said inlet diffuser is positioned in the middle of said vessel.

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22. A carbonation system according to claim 14, wherein said vessel is cylindrical in shape.
- 5 23. A carbonation system according to claim 14, wherein the longitudinal axis of said vessel is in a horizontal plane.
- 10 24. A carbonation system according to claim 14, wherein the plurality of openings are oriented to eject the atomized liquid substantially along the longitudinal axis of said vessel.
- 15 25. A carbonation system according to claim 14, wherein said vessel comprises end walls at either longitudinal end and the plurality of openings are oriented to eject the atomized liquid toward the end walls of said vessel.
- 20 26. A carbonation system according to claim 14, wherein said vessel comprises side walls and end walls at either longitudinal end of said side walls, and the plurality of openings are oriented such that the atomized liquid is not ejected toward the side walls of said vessel.
- 25 27. A carbonation system according to claim 14, wherein said vessel comprises side walls and end walls at either longitudinal end of said side walls, and the plurality of openings are oriented such that the atomized liquid is not ejected toward a central region of the side walls of said vessel.
29. A carbonation system comprising:  
a vessel for carbonating a liquid;  
a CO<sub>2</sub> supply connected to said vessel so as to create a CO<sub>2</sub> atmosphere in  
said vessel;

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an inlet diffuser through which the liquid enters said vessel, said inlet diffuser comprising a plurality of openings arranged on a vertical face, wherein the plurality of openings are oriented such that when the liquid exits said inlet diffuser through the plurality of openings, the liquid is substantially atomized and the atomized liquid is ejected at an upward angle relative to a horizontal plane of said vessel; and

an outlet pipe through which the carbonated liquid exits said vessel.

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30. A carbonation system according to claim 29, wherein the upward angle is between approximately 35 and 85 degrees.

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31. A carbonation system according to claim 29, where in the inlet liquid pressure is approximately 100 to 140 psi.

32. A carbonation system according to claim 29, wherein the plurality of openings are holes.

33. A carbonation system according to claim 32, wherein the diameters of the holes are approximately 0.020-0.036 inches.

34. A carbonation system according to claim 29, wherein the plurality of openings are slots.

35. A carbonation system according to claim 29, wherein the plurality of openings are a combination of holes and slots.

36. A carbonation system according to claim 29, wherein said inlet diffuser is positioned in the middle of said vessel.

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37. A carbonation system according to claim 29, wherein said vessel is cylindrical in shape.

38. A carbonation system according to claim 29, wherein the plurality of openings are arranged in a plurality of horizontal rows.

5 39. A carbonation system according to claim 38, wherein the plurality of horizontal rows are arranged such that openings in adjacent rows of the plurality of openings are not in vertical alignment with each other.

40. A carbonation system according to claim 29, wherein the longitudinal axis of said vessel is in a horizontal plane.

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41. A carbonation system according to claim 29, wherein said vessel comprises end walls at either longitudinal end and the plurality of openings are oriented to eject the atomized liquid toward the end walls of said vessel.

15 42. A carbonation system according to claim 29, wherein said vessel comprises side walls and end walls at either longitudinal end of said side walls, and the plurality of openings are oriented such that the atomized liquid is not ejected toward the side walls of said vessel.

20 43. A carbonation system according to claim 29, wherein said vessel comprises side walls and end walls at either longitudinal end of said side walls, and the plurality of openings are oriented such that the atomized liquid is not ejected toward a central region of the side walls of said vessel.

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44. A method for carbonating a liquid comprising the steps of:  
providing a vessel for carbonating a liquid, where the longitudinal axis of the vessel is in the horizontal plane;  
supplying a CO<sub>2</sub> atmosphere in the vessel;  
pumping the liquid into an inlet diffuser to atomize the liquid and eject the  
30 atomized liquid into the vessel in a direction that is substantially in the horizontal

plane by forcing the liquid through a plurality of openings arranged on a vertical face of the diffuser; and

discharging the carbonated liquid out of the vessel.

5        45. A method according to claim 44, wherein the atomized liquid is ejected substantially along the longitudinal axis of the vessel.

10      46. A method according to claim 44, wherein the vessel comprises end walls at either longitudinal end, and the atomized liquid is ejected toward the end walls of the vessel.

15      47. A method according to claim 44, wherein the vessel comprises side walls and end walls at either longitudinal end of the side walls, and the atomized liquid is not ejected toward the side walls of the vessel.

20      48. A method according to claim 44, wherein the vessel comprises side walls and end walls at either longitudinal end of the side walls, and the atomized liquid is not ejected toward a central region of the side walls of the vessel.

25      49. A method for carbonating a liquid comprising the steps of:  
                providing a vessel for carbonating a liquid;  
                supplying a CO<sub>2</sub> atmosphere in the vessel;  
                atomizing the liquid and ejecting the atomized liquid into the vessel through a plurality of openings arranged on a vertical face of an inlet diffuser, wherein the plurality of openings are arranged in horizontal rows such that openings in adjacent rows of the plurality of openings are not in vertical alignment with each other; and  
                discharging the carbonated liquid out of the vessel.

30      50. A method according to claim 49, wherein the atomized liquid is ejected substantially along the longitudinal axis of the vessel.

51. A method according to claim 49, wherein the vessel comprises end walls at either longitudinal end, and the atomized liquid is ejected toward the end walls of the vessel.

5 52. A method according to claim 49, wherein the vessel comprises side walls and end walls at either longitudinal end of the side walls, and the atomized liquid is not ejected toward the side walls of the vessel.

10 53. A method according to claim 49, wherein the vessel comprises side walls and end walls at either longitudinal end of the side walls, and the atomized liquid is not ejected toward a central region of the side walls of the vessel.

15 54. A method for carbonating a liquid comprising the steps of:  
providing a vessel for carbonating a liquid;  
supplying a CO<sub>2</sub> atmosphere in the vessel;  
atomizing the liquid and ejecting the atomized liquid into the vessel at an upward angle relative to a horizontal plane of the vessel; and  
discharging the carbonated liquid out of the vessel.

20 55. A method according to claim 54, wherein the atomized liquid is ejected substantially along the longitudinal axis of the vessel.

25 56. A method according to claim 54, wherein the vessel comprises end walls at either longitudinal end, and the atomized liquid is ejected toward the end walls of the vessel.

30 57. A method according to claim 54, wherein the vessel comprises side walls and end walls at either longitudinal end of the side walls, and the atomized liquid is not ejected toward the side walls of the vessel.

58. A method according to claim 54, wherein the vessel comprises side walls and end walls at either longitudinal end of the side walls, and the atomized liquid is not ejected toward a central region of the side walls of the vessel.